

**FIFTH SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/  
TECHNOLOGY — MARCH, 2015**

**STRUCTURAL DESIGN**  
(Common to CE, EN, WR, QS and AR)

[Time : 3 hours]

(Maximum marks : 100)

[Note :— Use of IS 456-2000, IS 800-2007, SP-16 and Steel tables are permitted.]

Marks

**PART—A**  
(Maximum marks : 10)

I Answer all questions in one or two sentences. Each question carries 2 marks.

1. What is meant by characteristic load ?
2. How a column is classified into short column and long column ?
3. What is meant by gauge distance ?
4. What are the three types of welded joints ?
5. What are the elements of a plate girder ?

(5×2=10)

**PART—B**  
(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Explain the following :
  - (i) Balanced Section
  - (ii) Under reinforced Section
  - (iii) Over reinforced Section.
2. A singly reinforced beam 250 × 500mm effective depth is subjected to a factored shearforce of 70KN. It is reinforced with tensile reinforcement of 6 bars, 20mm dia, concrete M20 grade and steel Fe 415 grade. Design the shear reinforcement.
3. A rectangular column 250mm × 400mm is provided with longitudinal steel of 6 bars of 20mm dia with Fe 415 grade. Concrete of M20 grade. Find the ultimate load capacity of the column.
4. Under what circumstances torsion reinforcements are provided in a slab ? What is the code provision ?
5. Write down the advantages and disadvantages of Bolted connection.

6. Design a suitable longitudinal fillet weld to connect 130mm × 8mm plate to 160mm × 10mm plate to transmit a pull equal to the full strength of small plate. Assuming welding is to be made in the field.
7. An I section with over all depth 250mm have its top flange 120 × 10mm and bottom flange 200 × 10mm. Thickness of web is also 10mm. Determine the plastic moment capacity and plastic modulus of the I section. (5×6=30)

## PART—C

(Maximum marks : 60)

(Answer one full question from each unit. Each full question carries 15 marks.)

## UNIT—I

- III (a) Distinguish between  $X_u$  and  $X_u$  limit. Classify the section based on the relation between  $X_u$  and  $X_u$  limit. 6
- (b) Find the Ultimate moment of resistance of a doubly reinforced beam for the following details. Breadth : 250mm, Effective depth : 500mm,  $Com$  : reinforcement : 3Nos. 16mm dia, Tensile steel : 6Nos. 20mm dia, Effective cover : 40mm. M20 concrete and Fe 415 steel. 9

OR

- IV (a) Explain : (i) Limit state of collapse (ii) Limit state of serviceability. 6
- (b) A T – beam has a flange of 1600mm × 120mm and rib 250mm × 400mm. The section is provided with tensile reinforcement of 6 bars 20mm dia and compression reinforcement 3 Nos. 16mm dia. Check the stiffness of the beam, if the span is 8m, simply supported and  $f_y = 415N/mm^2$ . 9

## UNIT—II

- V (a) Explain the following foundations :  
(i) Spread footing (ii) Strap footing (iii) Combined footing. 6
- (b) Design a short circular R.C.C. column with lateral ties to carry an axial load of 900KN. Use M25 concrete and Fe 415 grade steel. 9

OR

- VI (a) How is effective span of stairs determined under different conditions ? 6
- (b) Design a cantilever slab with an overhang of 1.2m from a wall of 300mm thick. The live load on the slab is 2.5KN/m<sup>2</sup>. Carry out checks for shear and deflection. 9

## UNIT—III

- VII (a) Define :  
(i) Slenderness ratio (iii) Appropriate radius of Gyration.  
(ii) Effective length 6
- (b) A column 5m long has to support a factored load of 3600KN. The column is held effectively at both ends and restrained in direction at one end. Design the column using beam sections and plates. 9

OR

- VIII (a) Sketch the following built up columns :
- (i) Battened column                      (iii) Laced and battened column.
- (ii) Single laced column
- (b) A tie member of a roof stress consists of 2 ISA 10075, 8mm. The angles are connected to either side of a 10mm gusset plates and the member is subjected to a working pull of 320KN. Design the welded connection. Assume the connections are made in the workshop.

6

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## UNIT—IV

- IX (a) Sketch the cross section of a plate girder and mark the following elements :

- (i) Web    (iv) Vertical Stiffener
- (ii) Flange                                        (v) Horizontal stiffener.
- (iii) Flange angle

6

- (b) Design angle purlin for the following data :

Spacing of trusses = 3.6m

Spacing of purlins = 1.6m

Weight of A.C. sheets including laps and fixtures = 0.205KN/m<sup>2</sup>.

Live load = 0.6KN/m<sup>2</sup>.

Wind load = 1KN/M<sup>2</sup>, Suction

Inclination of main rafter of truss = 21°.

9

OR

- X (a) Define :

- (i) Plastic moment capacity                      (ii) Plastic hinge.

6

- (b) Design a simply supported beam of effective span 2.5m carrying a factored concentrated load of 300KN at mid span.

9

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